

New records and a new species of chewing lice (Phthiraptera, Amblycera, Ischnocera) found on Columbidae (Columbiformes) in Pakistan

Saima Naz^{1,†}, Oldrich Sychra^{2,‡}, Syed Anser Rizvi^{1,§}

1 Department of Zoology, University of Karachi, Karachi, 75270, Pakistan **2** Department of Biology and Wildlife Diseases, Faculty of Veterinary Hygiene and Ecology, University of Veterinary and Pharmaceutical Sciences, Palackého 1–3, 612 42 Brno, Czech Republic

† [urn:lsid:zoobank.org:author:CD5C90B3-70D5-403B-A2C5-8C401A794793](https://zoobank.org/urn:lsid:zoobank.org:author:CD5C90B3-70D5-403B-A2C5-8C401A794793)

‡ [urn:lsid:zoobank.org:author:D28CEAFB-0F34-4937-A66E-6AC8BA90E325](https://zoobank.org/urn:lsid:zoobank.org:author:D28CEAFB-0F34-4937-A66E-6AC8BA90E325)

§ [urn:lsid:zoobank.org:author:8D9458F2-1D57-49F1-A44C-590CECB19842](https://zoobank.org/urn:lsid:zoobank.org:author:8D9458F2-1D57-49F1-A44C-590CECB19842)

Corresponding author: Saima Naz (symanaz@hotmail.com; dr.symanaz@gmail.com)

Academic editor: V. Smith | Received 19 January 2011 | Accepted 6 March 2012 | Published 9 March 2012

[urn:lsid:zoobank.org:pub:BFE6B4B2-6F82-460C-95D4-98B03C97DAD9](https://zoobank.org/pub/BFE6B4B2-6F82-460C-95D4-98B03C97DAD9)

Citation: Naz S, Sychra O, Rizvi SA (2012) New records and a new species of chewing lice (Phthiraptera, Amblycera, Ischnocera) found on Columbidae (Columbiformes) in Pakistan. ZooKeys 174: 79–93. doi: 10.3897/zookeys.174.2717

Abstract

The chewing lice (Phthiraptera) of Columbidae (Columbiformes) from Pakistan are studied. Six species of chewing lice with new host records are recorded and one new species of the genus *Colpocephalum* is described from *Columba livia* in the Karachi region. All the columbid chewing lice from Pakistan are keyed out and the new species is illustrated and compared with the closest allied species.

Keywords

chewing lice, Columbidae, Pakistan, new records, new species, taxonomy

Introduction

The study of chewing lice in Pakistan has been neglected for many years, especially in the Sindh region of Pakistan. During 1940s to 1950s, Ansari published his work on lice from Pakistan, but his studies were restricted to Lyallpur (now Faisalabad), in

the Punjab Province of Pakistan (Ansari 1947, 1951, 1955a–e, 1956a, b). Most of his work referred to the Punjab region of India (Ansari 1957a, b, 1958, 1959).

Lakshminarayana (1979) published a list of Mallophaga from India and its adjacent countries, listing only those chewing lice species that were reported by Ansari from Lyallpur, Pakistan.

After Ansari (1955b; 1958), no taxonomic studies have been carried out in Karachi, Pakistan. Here we present a key to species of columbid chewing lice of this region and describe a new species of the genus *Colpocephalum*. This new species is compared with the closest allied species of the genus.

Material and methods

The chewing lice used in this study were preserved on microscopic slides using a standard method (Palma 1978) and mounted in Canada-balsam. Line diagrams were made using micro-ocular graticule with a light microscope. Collected species have been deposited in the Natural History Museum, University of Karachi (NHMUK), Pakistan and the Moravian Museum (MZM), Burno, Czech Republic.

Abbreviations:

AL	Abdominal Length
DHS	Dorsal Head Seta
GL	Genital Length
HL	Head Length
ML	Metathorax Length
MW	Metathorax Width
PL	Pronotal Length
PML	Paramere Length
POW	Preocular Width
PW	Pronotal Width
TL	Total Length
TW	Temporal Width

Results

Chewing lice Species of Columbidae in Pakistan

Bonomiella columbae Emerson, 1957 – **New record**

Campanulotes bidentatus Scopoli, 1763 (Lakshminarayana 1979)

Campanulotes compar Burmeister, 1838 – **New record**

Coloceras piageti Johnston & Harrison, 1912 (Ansari 1947, Lakshminarayana 1979)
Colpocephalum afrozeae sp. n.
Colpocephalum turbinatum Denny, 1842 (Ansari 1951)
Columbicola columbae L. 1758 (Ansari 1947)
Columbicola theresae Ansari, 1955 (Lakshminarayana 1979)
Columbicola tschulyschman Eichler, 1942 – **New record**
Hohorstiella lata Piaget, 1880 – **New record**
Hohorstiella modesta Ansari, 1951 (Lakshminarayana 1979)
Hohorstiella streptopeliae Eichler, 1953 – **New record**
Turturicola salimalii Clay & Meinertzhagen, 1937 – **New record**

Key to the chewing lice species of Columbidae in Pakistan

- 1 Maxillary palpi present; meso and metathorax separated..... **Amblycera, 2**
- Maxillary palpi absent; meso and metathorax fused, forming pteronotum
..... **Ischnocera, 7**
- 2 Postpalpal process present..... **Hohorstiella, 3**
- Postpalpal process absent **5**
- 3 Head much broader than long; anterior head margin broadly convex; abdomen short and oval; three abdominal sternites (st. III–V) with thick setal brushes **H. modesta (Ansari)**
- Head broader than long; anterior head margin relatively more convex; abdomen large and oblong; two abdominal sternites with setal brushes **4**
- 4 Postpalpal process short; antennal segment II small and rounded; prosternal plate small; abdominal sternite IV–V with thin setal brushes; vulval margin wide with thin short to long setae **H. lata (Piaget)**
- Postpalpal process long; antennal segment II large and globulate; abdominal sternite III–IV with dense setal brushes; vulval margin narrow with thin microsetae to short fine setae..... **H. streptopeliae Eichler**
- 5 Head without ocular and occipital carinae; femur III and abdominal sternites without ctenidia..... **Bonomiella columbae Emerson**
- Head with ocular and occipital carinae; femur III and abdominal sternites with fine ctenidia **Colpocephalum, 6**
- 6 Femur III and abdominal sternite III with two fine ctenidia on each; male genital sclerite large, with short and fine latero–posterior points; penis short; female subgenital plate with medially short, stout setae..... **C. afrozeae sp. n.**
- Femur III and sternite III with three ctenidia on each; male genital sclerite with long and slightly curved latero–posterior points; penis long; female subgenital plate with lateral tufts of setae..... **C. turbinatum Denny**
- 7 Head circumfasciate; temples large or broad, angulated **8**
- Head non–circumfasciate; temples short and rounded..... **10**

- 8 Antennae dimorphic; scape very enlarged in male
 ***Coloceras piageti* (Johnston and Harrison)**
- Antennae monomorphic ***Campanulotes*, 9**
- 9 Female larger in size, not less than 1.58 mm long; ventral median setae on sternites VI and VII absent ***C. bidentatus* (Scopoli)**
- Female smaller in size, not more than 1.34 mm long; ventral median setae on sternites VI and VII present ***C. compar* (Burmeister)**
- 10 Median head setae blade-like, on anterior dorsal plate; anterior dorsal plate divided medially; preantennal width narrow ***Columbicola*, 11**
- Median head setae not blade-like, on anterior dorsal plate; anterior dorsal plate complete; preantennal width broad
 ***Turturicola salimalii* Clay and Meinertzhagen**
- 11 Head length more than 0.55mm; posterior median head setae spike-like, shorter than anterior median head setae; male genitalia with triangular mesosomal plate, with groves directed towards median; female subgenital plate without lateral row of setae, grove with clear lateral indentations
 ***C. theresae* Ansari**
- Head length less than 0.55mm; posterior median head setae hair like or spike like, equal or longer than anterior median head setae; male genitalia with medially divided mesosomal plate, with anterior grove, bearing pores in or out of the pigmented border; female subgenital plate with lateral row of setae, grove without indentations **12**
- 12 Posterior median head setae hair-like and longer than anterior median head setae; male genitalia with relatively long, straight and posteriorly narrower parameres, mesosomal plate with shallow and narrow anterior grove, two pairs of pores present at mediolateral margins of mesosomal plate; female subgenital plate narrow with smooth posterior grove ***C. tschulyschman* Eichler**
- Posterior median head setae spike-like, more or less equally long to anterior median head setae; male genitalia with short, stumpy parameres, curved inside outwards, mesosomal plate with large or deep anterior grove, anterior pair of mesosomal pores present at lateral margins within the dark pigmented borders; female subgenital plate relatively wider with wavy posterior grove, long and wide, bearing 4–8 pairs of medium to long setae ***C. columbae* (L.)**

Suborder Amblycera Kellogg, 1896

Family Menoponidae Mjöberg, 1910

***Bonomiella columbae* Emerson**

http://species-id.net/wiki/Bonomiella_columbae

Bonomiella columbae Emerson 1957: 63, 1972: 37, Selim et al. 1968: 79, Hill and Tuff 1978: 308, 316, Price et al. 2003: 93, 303, 308.

Material examined. 2 females, on *Columba livia* (Gmelin); Pakistan: Karachi; 21-V-2004; leg. Naz.

New record from Pakistan.

***Colpocephalum afrozeae* sp. n.**

urn:lsid:zoobank.org:act:CC7DD2BC-D82F-4E06-89E7-8C3EB8A5739F

http://species-id.net/wiki/Colpocephalum_afrozeae

Figs 1–12

Holotype. male, on *Columba livia* (Gmelin); Pakistan: Karachi; 20-VII-2006; leg. Naz, S.

Paratype. 8 males, 12 females, on *Columba livia* (Gmelin); Pakistan: Karachi; 20-VII-2006; leg. Naz, S.

Other material. 6 nymphs, on *Columba livia* (Gmelin), with data as above.

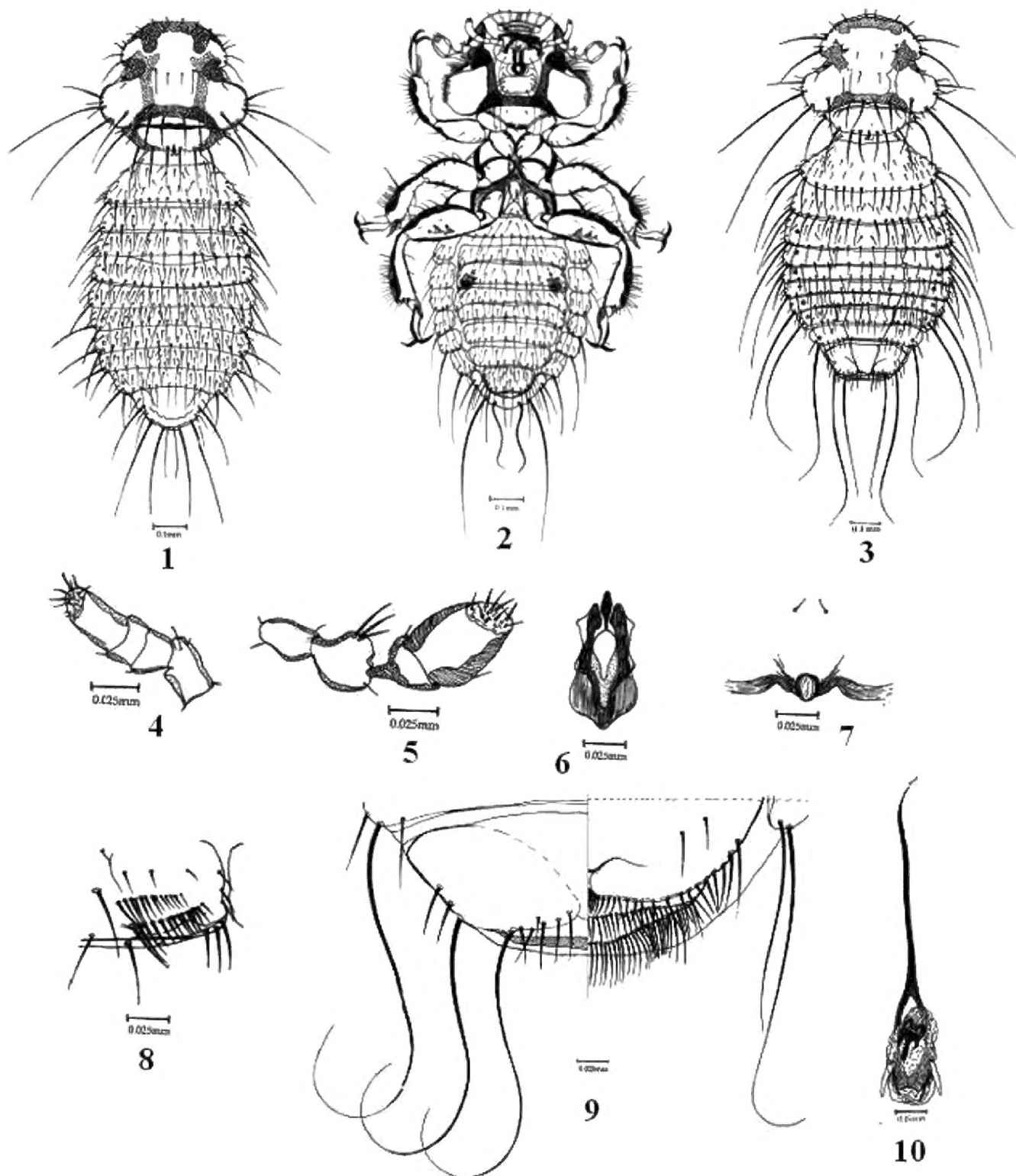
Type host. *Columba livia* (Gmelin) (Columbiformes: Columbidae).

Measurements. TL: male 1.242 (1.24–1.245) (Figs 1–2), female 1.330 (1.285–1.375) (fig. 3); HL: male 0.287 (0.286–0.288), female 0.302 (0.30–0.305); POW: male 0.318 (0.315–0.332), female 0.347 (0.345–0.35); TW: male 0.45 (0.445–0.455), female 0.492 (0.48–0.505); PL: male 0.12 (0.11–0.13), female 0.137 (0.135–0.14); PW: male 0.288 (0.255–0.322), female 0.332 (0.325–0.34); ML: male 0.135 (0.12–0.15), female 0.152 (0.15–0.155); MW: male 0.374 (0.322–0.426), female 0.51 (0.505–0.515); AL: male 0.658 (0.642–0.675), female 0.697 (0.685–0.71), GL: 1.03 (1.01–1.05), GW: 0.155 (0.15–0.16), PML: 0.055 (0.050–0.060).

Head (Figs 1–6). Anterior marginal carina very thick, with large and blunt marginal nodi; DHS 8–10 short fine to stout setae; DHS 15 long; occipital setae 21–22 thick setae of normal length; ventral subtemporal setae present; ocular and occipital nodi very well developed, connected with thick oculo–occipital and occipital carinae; maxillary palpi as in fig. 4; antennae (fig. 5) four segmented, pedicel large with short lateral process, bearing three stout sharp setae, flagellomere II long, oval with broad terminal disc; hypopharynx (fig. 6) very well developed.

Thorax (Figs 1–3, 7). Pronotal carina very thickly sclerotized; pronotal seta 2 minute peg-like setae; lateral to posterior margin of pronotum with four long and at least two short setae; prosternal plate (fig. 7) weakly developed, short, with posterior margin convex and lateral margins absent, one pair of small microsetae anterior to the plate present; posterior margin of metanotum straight, with 8–10 normal fine setae, arranged equally without any gape; femur III with two ctenidia.

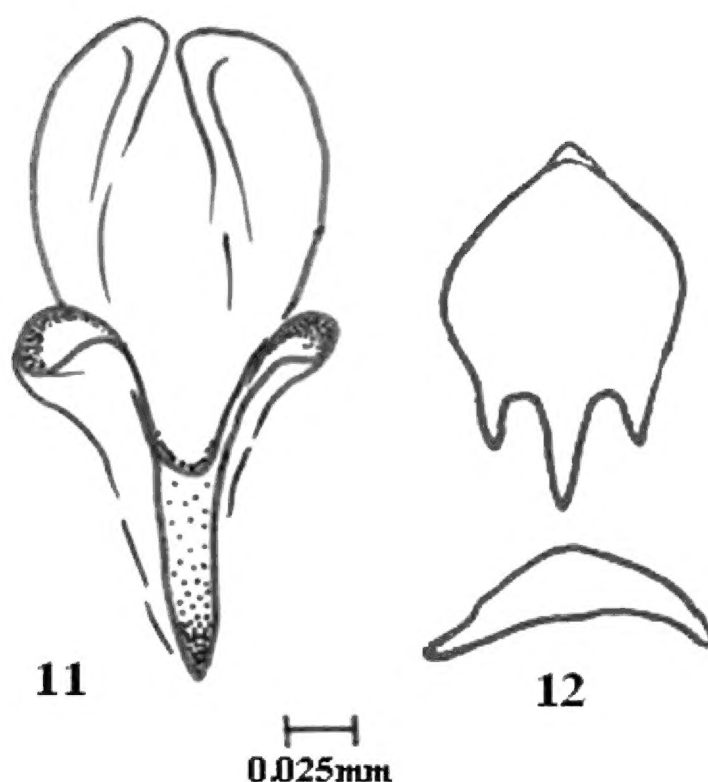
Abdomen (Figs 1–3, 8). Male. Tergal plates complete, marginal setae from tergite I–VIII: 12, 14, 17, 18, 16, 16, 15 and 13 respectively; anterior tergal setae scattered, ranging from 14–28 microsetae; postspiracular seta long on segment II, V–VII, shorter on segments III–IV and VIII; sternal setae in double rows on sternites I–VII: 15, 24, 16 (+ two large ctenidia on segment III; fig. 8), 24, 21, 20 and 16 respectively. Terminalia (Figs 1–2): Terminal segment comprises segments IX and X, posteriorly rounded; large tergal plate usually without anterior setae, latero–posterior margin with



Figures 1–10. *Colpocephalum afrozeae* sp. n. **1** male dorsal view **2** male ventral view **3** female dorsal view **4** maxillary palp **5** antenna; **6** hypopharynx **7** prosternal plate **8** sternite IV with ctenidia **9** female terminalia ventral view **10** male genitalia

two long macrosetae and posterior margin bears four long macrosetae and two short fine setae; sternites VIII forming a short subgenital plate, bearing dense scattered small thin setae; anal margin almost straight.

Female. Tergites I and II complete, wide and long, tergites III–VIII divided, tripartite, narrow and short; tergoventral setae on segment I and II long; tergal marginal setae from I–VIII: 20, 20–22, 16–18, 18–20, 16–19, 17, 18 and 14–16 respectively; postspiracular setae long on II–III, VI–VIII; segment VIII with one pair of long, latero-anterior setae; sternite I developed, sternite II–VIII complete and well sclerotized; sternal setae small short to fine, scattered all over the plates; sternite III with two long



Figures 11–12. *Colpocephalum afrozeae* sp. n. 11 penis details 12 genital sclerite.

ctenidia (fig. 8). Terminalia (fig. 9): Terminal segment widely rounded posteriorly; tergite IX divided, median piece triangular; posterior margin of lateral plates with small fine setae and two pairs of long macrosetae; anus narrow, transverse with tapering ends; anal fringes bear forty three stout microsetae in anterior fringe and forty seven to fifty fine curved setae in posterior fringe; vulval margin medially concave, with small thick, stout curved setae, gradually larger at latero–posterior ends.

Male genitalia (Figs 10–12). Elongated; genital sclerite (fig. 12) short, with long and slightly curved latero-posterior points; genital lateral plates short and thick; basal plate thick and broad; median process long; penis (fig. 11) terminally narrow; parameres straight, tubular.

Remarks. *Colpocephalum afrozeae* were collected from *Columba livia* on which *C. turbinatum* has been reported previously. The two species of the genus *Colpocephalum* of *C. livia* are different from each other. *C. afrozeae* has the anterior margin of head broadly convex; anterior marginal carina thick; oculo-occipital carina thick; prothorax with two short marginal setae; femur III with two ctenidia; female tergite II with long tergo-central setae; postspiracular setae long on tergites II–III and VI–VIII; lateral plates of male genitalia very short; lateroposterior points of genital sclerite large and curved; median process reduced; female genital reticulation invisible; vulva medially concave; anus narrow and transverse.

Colpocephalum afrozeae has also some similarities with *Colpocephalum arfakiani* Price and Beer, but they have morphological differences, which consist of a thin anterior marginal carina; five long pronotal marginal setae; tergite II of female divided; tergite VIII with small triangular median piece; anal opening broad, with light fringe of short setae; male genital sclerite without latero-posterior points and long lateral plates are found in *C. arfakiani* whereas the anterior margin very thick; four pronotal marginal setae long; tergite II of female complete; tergite VIII with large trapezoidal piece; anal opening narrow and transverse, with dense fringe of

short setae in anterior margin and thick, long setae on posterior margin; male genital sclerite with long and curved latero-posterior points and short lateral plates are found in *C. afrozeae*.

Etymology. The present species is named after Mrs Hussan Afroze, mother of the first author.

***Colpocephalum turbinatum* Denny**

http://species-id.net/wiki/Colpocephalum_turbinatum

Fig. 13–16

Colpocephalum turbinatum Denny 1842: 198, 209, Harrison 1916: 56, Hopkins and Clay 1952: 84, Price and Beer 1963: 735, 736, 754, Hill and Tuff 1978: 308, 315, Lakshminarayana 1979: 80, Price et al. 2003: 102, 303, 304, 308.

C. abruptofasciatum Mjöberg 1910: 36.

C. ailurum Nitzsch (In Giebel) 1861: 522.

C. bicinctum Nitzsch (In Giebel) 1861: 524.

C. caudatum Giebel 1874: 261, Piaget 1880: 519, 1885: 125.

C. dissimile Piaget 1880: 520, 1885: 119.

C. intermedium Piaget 1880: 521.

C. latifasciatum Piaget 1885: 130.

C. osborni Carriker 1903: 172.

C. oxyurum Nitzsch (In Giebel) 1861: 519.

C. subflavescens Piaget 1880: 571.

C. tricinctum Nitzsch (In Giebel) 1861: 524, Ansari 1951: 154.

C. wernecki Orfila 1959: 477.

Neocolpocephalum gypae Qadri 1935: 229.

N. tricinctum Eichler 1941: 374.

Vulturigogus eugenii Eichler and Zlotorzyska 1963: 207.

V. femellus Eichler and Zlotorzyska 1963: 209.

Material examined. 91 males, 105 females, on *Columba livia* (Gmelin); Pakistan: Karachi; 21-V-2004, 23-IX-2007; leg. Naz.

***Hohorstiella lata* (Piaget)**

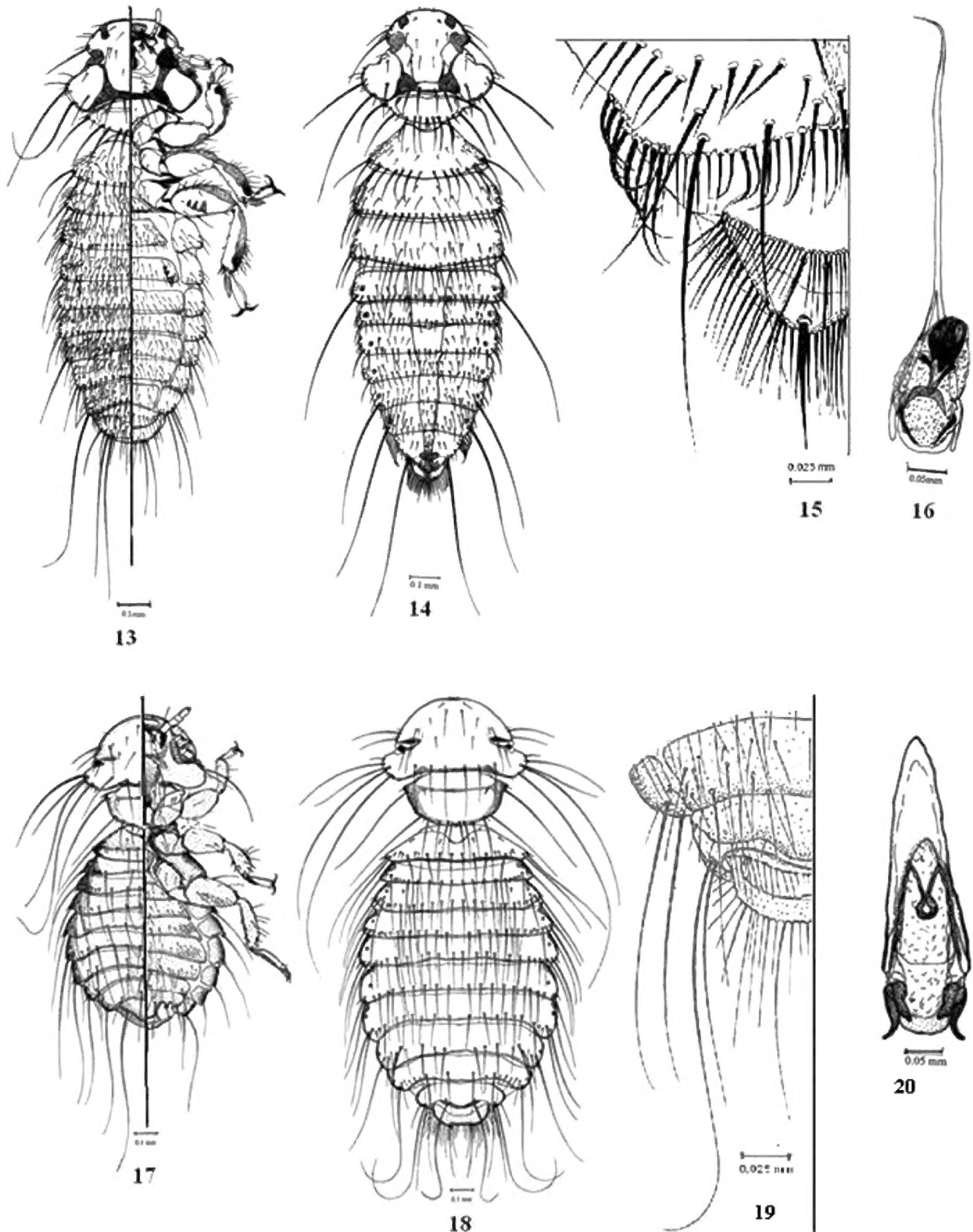
http://species-id.net/wiki/Hohorstiella_lata

Fig. 17–20

Menopon latum Piaget 1880: 457.

Menopon giganteum Denny 1842: 225, Harrison 1916: 39.

Hohorstiella lata Eichler 1940: 362, Hopkins and Clay 1952: 173, Hill and Tuff 1978: 308, 310, Price et al. 2003: 111, 303.



Figures 13–20. 13–16. *Colpocephalum turbinatum* Denny 13 male dorso-ventral view 14 female dorsal view 15 female terminalia 16 male genitalia. 17–20. *Hohorstiella lata* (Piaget) 17 male dorso-ventral view 18 female, dorsal view; 19, female terminalia 20 male genitalia.

Material examined. 25 males, 39 females, on *Columba livia* (Gmelin), *Streptopelia decaocta* (Frivaldszky); Pakistan: Karachi; 21-V-2004, 04-VIII-2006; leg. Naz. New record from Pakistan.

***Hohorstiella streptopeliae* Eichler**

http://species-id.net/wiki/Hohorstiella_streptopeliae

Fig. 21

Hohorstiella streptopeliae Eichler 1953: 169, Price et al. 2003: 111, 307.

Material examined. 4 females, on *Columba livia domestica* (Gmelin) (Fantail Pigeon breed); Pakistan: Karachi; 15-VII-2006; leg. Naz.

New record from Pakistan.

Suborder Ischnocera Kellogg, 1896**Family Philopteridae Burmeister, 1838*****Campanulotes compar* (Burmeister)**

http://species-id.net/wiki/Campanulotes_compar

Fig. 22–25

Goniocotes bidentatus Scopoli 1763: 385, Harrison 1916: 80.

G. compar Burmeister 1838: 431.

G. formosanus Sugimoto 1929: 25.

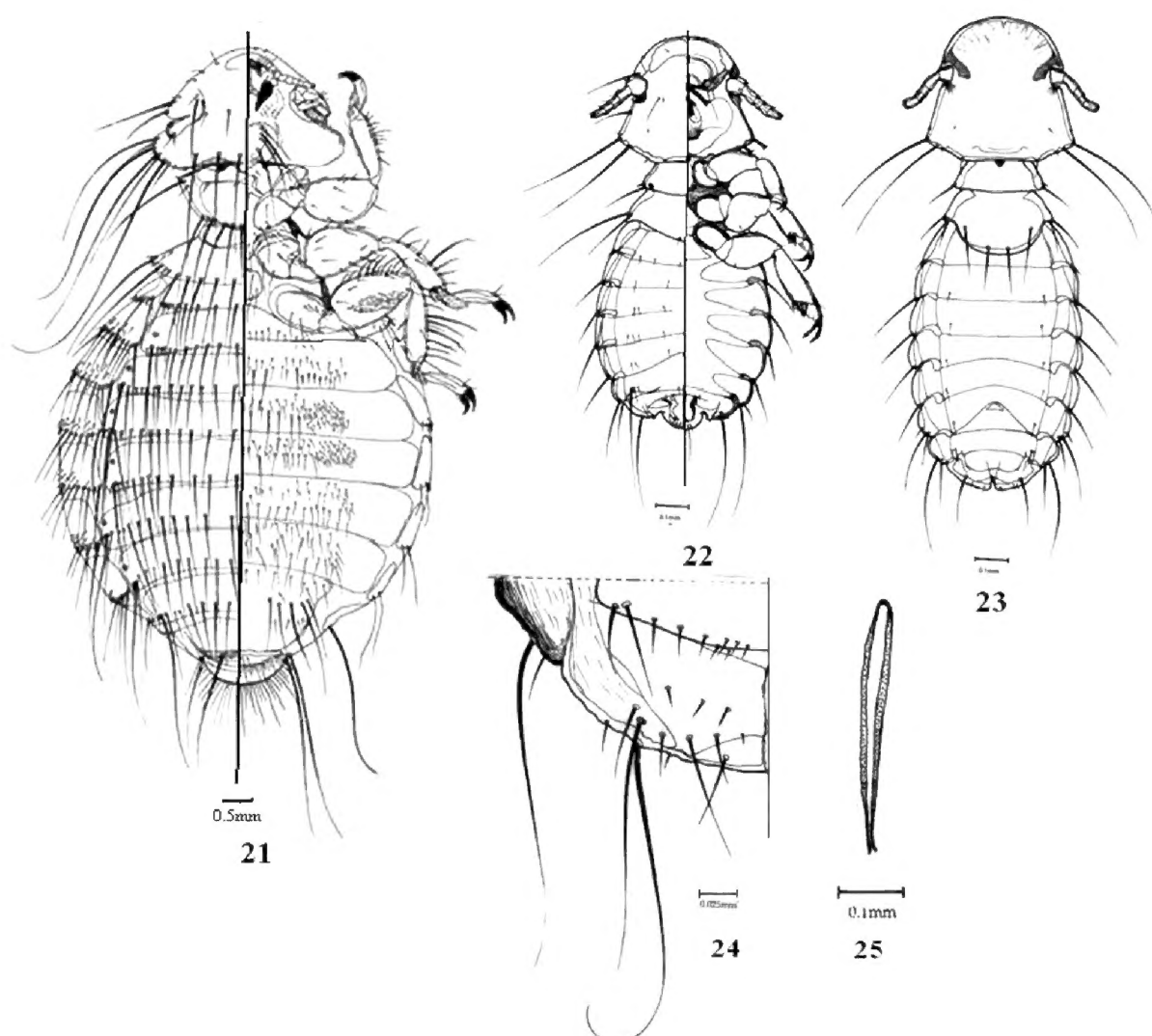
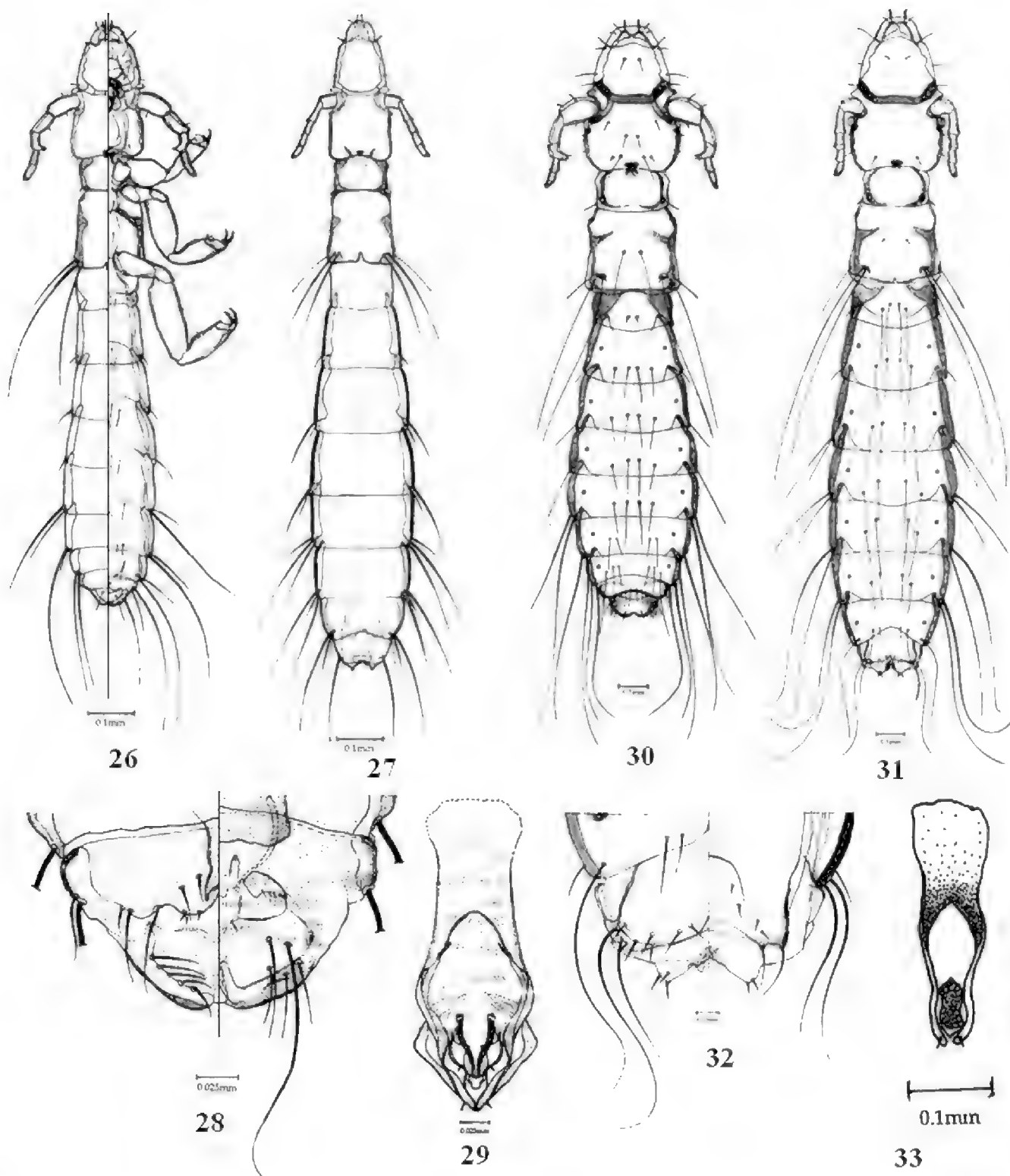


Figure 21–25. 21 *Hohorstiella streptopeliae* Eichler, female, dorso-ventral view. 22–25 *Campanulotes compar* (Burmeister) 22 male dorso-ventral view 23 female dorsal view 24 female terminalia 25 male genitalia.



Figures 26-33. 26–29 *Columbicola columbae* (L.) 26 male dorso-ventral view 27 female dorsal view 28, male terminalia dorso-ventral view 29 male genitalia. 30–33 *Columbicola tschulyschman* Eichler 30 male dorsal view 31 female dorsal view 32 female terminalia dorso-ventral view 33 male genitalia.

Goniodes compar Nitzsch 1818: 294, Denny 1842: 13, Giebel 1842: 12, Piaget 1842: 234, Neumann 1909: 31, Neveu-Lemaire 1919: 1116.

Campanulotes compar Keler 1939: 157, Hopkins and Clay 1952: 64, Ansari 1955: 48, Selim et al. 1968: 79, Hill and Tuff 1978: 309, 322, Tendeiro 1969: 380, 1978: 117, Lakshminarayana 1979: 70, Price et al. 2003: 160, 303.

Material examined. 51 males, 72 females, on *Columba livia* (Gmelin); Pakistan: Karachi, Hyderabad, Khairpur mir's; 21-V-2004, 04-VIII-2006; leg. Naz.

New record from Pakistan.

***Columbicola columbae* (L.)**

http://species-id.net/wiki/Columbicola_columbae

Fig. 26–29

Pediculus columbae L. 1758: 614.

Lipeurus bacillus Nitzsch 1818: 215.

L. baculus Giebel 1866: 379, Kellogg 1896: 506, Neumann 1909: 30.

L. antennatus Giebel 1874: 213.

Philoaterus baculus Nitzsch 1818: 293.

Phagopterus columbae Freire and Duarte 1944: 14.

Nirmus claviformis Olfers 1816: 90.

N. filiformis Olfers 1816: 90.

Esthiopterum columbae Harrison 1916: 132.

Columbicola columbae Ewing 1929: 117, Ansari 1947: 259, Hopkins and Clay 1952: 86, Tendeiro 1960: 530, 533, Selim et al. 1968: 76, Hill and Tuff 1978: 309, 317, Lakshminarayana 1979: 82, Clayton and Price 1999: 675, Price et al. 2003: 166, 303.

Material examined. 48 males, 73 females, on *Columba livia intermedia* (Gmelin), *Columba livia neglecta* Hume; Pakistan: Karachi; 21-V-2004, 23-IX-2007; leg. Naz. New host record from Pakistan.

***Columbicola tschulyschman* Eichler**

http://species-id.net/wiki/Columbicola_tschulyschman

Fig. 30–33

Columbicola tschulyschman Eichler 1942: 28, Tendeiro 1960: 531, 571, Hopkins and Clay 1952: 88, Price et al. 2003: 168, 303.

Columbicola montschadskyi Blagoveshtchensky 1951: 308, Tendeiro 1965: 131.

Material examined. 5 males, 6 females, on *Columba livia neglecta* Hume; Pakistan: Karachi; 16-VIII-2007; leg. Naz.

New record from Pakistan.

***Turturicola salimalii* Clay & Meinertzhagen**

http://species-id.net/wiki/Turturicola_salimalii

Turturicola salimalii Clay and Meinertzhagen 1937: 278, Ansari 1947: 260, Hopkins and Clay 1952: 360, Tendeiro 1965: 26, 48, Lakshminarayana 1979: 174, Price et al. 2003: 246, 307.

Material examined. 2 females, on *Columba livia* (Gmelin); Pakistan: Karachi; 16-VII-2005; leg. Naz.

New host record from Pakistan.

Discussion

This study is the first survey of chewing lice of family Columbidae in Pakistan. Among the nine species found in this region, six species are recorded for the first time. Four of them, *Campanulotes compar*, *Colpocephalum turbinatum*, *Columbicola columbae* and *Hohorstiella lata*, are cosmopolitan (Emerson 1972, Ledger 1980, Mey 2003, Naz and Rizvi 2004, Naz et al. 2010).

Only two species of the genus *Colpocephalum* have been recorded from Columbidae, which are *C. longicaudum* Nitzsch 1866 on *Streptopelia chinensis tigrina* (Temminck) and *C. turbinatum* on *Columba livia* Gmelin (Price and Beer 1963, Price et al. 2003). Kellogg and Paine (1914) have reported *C. longicaudum* from *Columba livia*. Price and Beer (1963) have recorded *C. turbinatum* from various species of Falconiformes. Ansari (1951) reported *C. turbinatum* from *Milvus migrans govinda* Sykes (Accipitridae: Falconiformes) with the synonym *C. tricinctum*, in Lyallpur, Pakistan (Lakshminarayana 1979). Here, this species is reported from *Columba livia* in Karachi, Pakistan. Galloway and Palma (2008) showed that some species of lice can be overlooked for many decades even when they parasitize common hosts.

Columbicola tschulyschman is also a regular pigeon parasite. It is known from three species of *Columba* including *C. livia neglecta*, which is also found in Pakistan (Grimmett et al. 1999, Naz et al. 2010) and is probably still isolated from feral pigeons in Pakistan (Johnston 1996). There is no record of this louse species from feral pigeon (Adams et al. 2005).

The presence of *Hohorstiella streptopeliae* on *Columba livia* represents a case of straggling, because its type host is *Streptopelia turtur arenicola* (Hartlert) (Price et al. 2003). Ansari (1947) recorded *Turturicola salimalii* on three species of *Streptopelia* and on *Columba livia* from different regions of India, but he also collected this species from Passeriformes and Psittaciformes and suggested these hosts as likely stragglers.

Acknowledgements

The authors owe their special thanks to Dr Mohammad Atique Akhter, Department of Zoology, University of Karachi; the late Dr Robert C Dalglish and Dr Richardo L. Palma, and personal thanks to Dr. Vincent Smith for their critical reviews of the manuscript and valuable suggestions to improve the quality of this paper.

References

- Adams RJ, Price RD, Clayton DH (2005) Taxonomic revision of Old World members of the feather louse genus *Columbicola* (Phthiraptera: Ischnocera), including descriptions of eight new species. *Journal of Natural History* 39: 3545–6318. doi: 10.1080/00222930500393368
- Ansari MAR (1947) Mallophaga (Ischnocera) infesting birds in the Punjab (India). *Proceedings of the National Institute of Science, India* 13 (6): 253–303.
- Ansari MAR (1951) Mallophaga (Amblycera) infesting birds in the Panjab (India). *Proceedings of the National Institute of Science, India* 17 (2): 127–203.
- Ansari MAR (1955a) Studies on the Amblyceran Mallophaga infesting birds in Pakistan. *Proceedings of the Seventh Pakistan Scientific Conference, Agriculture Bahawalpur Pakistan*, 51–57.
- Ansari MAR (1955b) Phthirapteran parasites from the Zoological Survey of Pakistan, Karachi. *Proceedings of the Seventh Pakistan Scientific Conference Agriculture, Bahawalpur, Pakistan*, 58–59.
- Ansari MAR (1955c) Studies on the Ischnoceran Mallophaga, infesting birds in Pakistan. *Proceedings of the 7th Pakistan Scientific Conference Bahawalpur, Section Biology* 7: 52–53.
- Ansari MAR (1955d) Ischnoceran parasites from the Zoological Survey of Pakistan Karachi. *Proceedings of the Seventh Pakistan Scientific Conference Agriculture, Bahawalpur Pakistan*, 52–53.
- Ansari MAR (1955e) Studies on the Ischnoceran Mallophaga infesting birds in Pakistan. *Proceedings of the Seventh Pakistan Scientific Conference Biology, Bahawalpur Pakistan* 53–62.
- Ansari MAR (1956a) Some new Ischnoceran Mallophaga in the Zoological Survey Department Karachi. *Pakistan Journal of Scientific Research* 8 (1): 10–22.
- Ansari MAR (1956b) Description of some new Amblyceran Mallophaga from the Zoological Survey Department Karachi. *Pakistan Journal of Scientific Research* 8 (2): 57–61.
- Ansari MAR (1957a) Studies on the Amblyceran Mallophaga infesting birds in the Panjab Indian. *Journal of Entomology* 18 (4): 427–439.
- Ansari MAR (1957b) Studies on the Ischnoceran Mallophaga infesting birds in Pakistan. *Proceedings of the Seventh Pakistan Scientific Conference, Biology* 42: 42–62.
- Ansari MAR (1958) Studies on Ischnoceran Mallophaga infesting birds in the Panjab Indian. *Journal of Entomology* 20 (1): 46–62.
- Ansari MAR (1959) Studies on Ischnoceran Mallophaga infesting birds in the Panjab. *Indian Journal of Entomology* 20 (2): 77–103.
- Burmeister HCC (1838) Mallophaga: 418–443, In: *Handbuch der Entomologie* 2 (1), Enslin, Berlin.
- Clay T, Meinertzhagen R (1937) Two remarkable new Mallophagan genera from the Columbidæ. *The Entomologist* 70: 276–278.
- Denny H (1842) *Monographia Anoplurorum Britanniae* London: Henry G. Bohn 24: 1–262.
- Eichler W (1942) Notulae Mallophagologicae VIII *Heinrothiella inexpectata* nov gen et spec und einige andere z. T. neue Federlinge. *Zoologisch Anzeiger* 139: 27–31.
- Eichler W (1953) Mallophagen Synopsis XXI Genus *Columbicola*. *Zoologischer Anzeiger* 148: 346–356.
- Emerson KC (1957) A new species of Mallophaga from the pigeon. *Florida Entomologist* 40: 63–64. doi: 10.2307/3492306

- Emerson KC (1972) Checklist of the Mallophaga of North America (North of Mexico) Part IV Bird host list. Deseret Test Center, Dugway Proving Ground, Dugway, Utah, 216 pp.
- Galloway TG, Palma RL (2008) Serendipity with chewing lice (Phthiraptera: Menoponidae, Philopteridae) infesting rock pigeons and mourning doves (Aves: Columbiformes: Columbidae) in Manitoba, with new records for North America and Canada. *Canadian Entomologists* 140: 208–218. doi: 10.4039/n07-041
- Grimmett R, Inskipp C, Inskipp T (1999) Birds of India, Pakistan, Nepal, Bangladesh, Bhutan, Sri Lanka and the Maldives. Princeton University Press, 384pp.
- Johnston RF (1996) Geographic variation in size of female wild rock doves. *The Condor* 98: 437–439. doi: 10.2307/1369166
- Johnston TH, Harrison L (1912) A list of Mallophaga found on introduced and domesticated animals in Australia. *Proceedings of the Royal Society of Queensland* 24: 17–22.
- Kellogg VL (1896) New Mallophaga II. From land birds, together with an account of the mallophagous mouth parts. *Proceedings of the Californian Academy of Sciences* 6: 431–548.
- Kellogg VL, Paine JH (1914) Mallophaga from the birds (mostly Corvidae and Phasianidae) of India and neighboring countries. *Records of the Indian Museum* 10 (4): 217–243.
- Lakshminarayana KV (1979) A synoptic list of Mallophaga sens. lat. (Phthiraptera: Insecta) from India and adjacent countries together with host and regional indices. *Records of the Zoological Survey of India* 75: 39–201.
- Ledger JA (1980) Phthiraptera (Insecta). South African Institute for Medical Research Johannesburg.
- Linnaeus C (1758) *Systema Naturae* I; Laurentii Salvii, Holmiae.
- Mey E (2003) Verzeichnis der Tierläuse (Phthiraptera) Deutschlands. In: Klausnitzer B (Ed) *Entomofauna Germanica* 6. *Entomol Nach Ber Beiheft* 8. Dresden, 72–129.
- Mjöberg E (1910) Studien ber Mallophagen und Anopluren. *Arkiv för Zoologica* 6 (13): 1–269.
- Naz S and Rizvi SA (2004) The detailed morphological aspects of genital segments of *Columbicola columbae* (L) (Phthiraptera: Ischnocera) with special reference to its chaetotaxy and male genitalia *Pakistan Journal of Entomology* Karachi 19: 15–17.
- Naz S, Rizvi SA and Sychra O (2010) The high rate of infestation of the chewing lice (Phthiraptera) in rock pigeons (*Columba livia*) in Pakistan *Tropical Zoology* 23: 21–28.
- Nitzsch CL (1818) Die Familien und Gattungen der Thierinsekten (Insecta Epizoica), als Prodromus einer Naturgeschichte derselben. *Magazin der Entomologie* (Germar) 3: 261–316.
- Nitzsch CL (1866) Die Federlinge der Sing- Schrei- Kletter und Taubenvogel. *Zeitschrift für (die gesammten) Naturwissenschaften* (Halle) 27: 115–122.
- Palma RL (1978) Slide mounting of lice: a detailed description of the Canada Balsam technique. *The New Zealand Entomologist* 6 (4): 432–436.
- Piaget E (1880) *Les Pèdiculines* Essay monographique. EJ Brill, Leiden.
- Price RD, Beer JR (1963) Species of *Colpocephalum* (Mallophaga: Menoponidae) parasitic upon the Falconiformes. *The Canadian Entomologist* 95(7): 731–763. doi: 10.4039/Ent95731-7
- Price RD, Hellenthal RA, Palma RL, Johnson KP, Clayton DH (2003) The chewing lice: world checklist and biological overview Illinois Natural History Survey, Special Publication 24, 1–105+X.
- Scopoli GA (1763) *Entomologica carniolica exhibens insecta carniolica indigena et distribute in ordines, genera, species, varitates*. Wien *Pediculus*, 381–386.